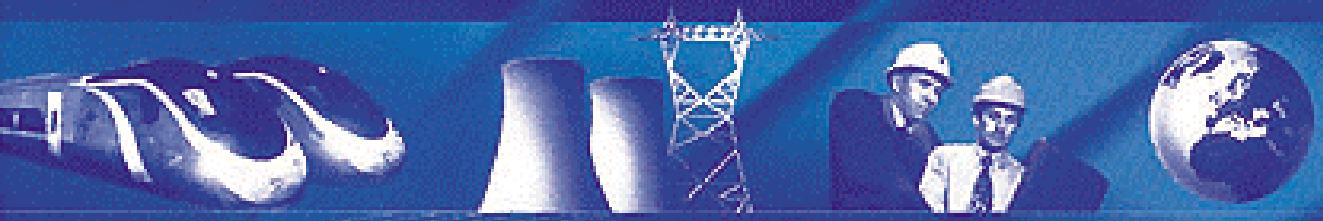
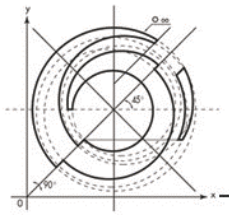


October
2002

Amtrak ACSES - RSAC update

Jim Hoelscher

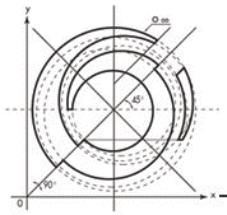
ALSTOM



Review

ACSES = Advanced Civil Speed Enforcement System

- Utilizes passive transponders mounted between the rails
  - Transponders describe the civil or track speed requirements for both directions of travel
- Onboard system utilizes a transponder reader, an on board computer (OBC) and Aspect Display Unit (ADU)
  - The onboard system reads and decodes the transponder messages and develops a speed distance profile based on the data received.
  - The current civil speed limit is displayed by the ADU and enforced by the OBC
- The 9 and 4 Aspect cab signal systems used on the NEC operate independently of ACSES. ACSES operates as an overlay system.



Review

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Cab Signal and ACSES interaction

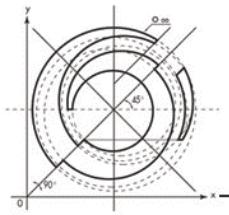
Cab Signal and ACSES systems operate independently with their own Magnet Valve control and <u>always</u> perform the following:

ACSES:
- Civil speed enforcement (PSR, Route Dependent PSR, Civil Speed by radio through IXL and TSR).

Cab Signal:
- Signal speed enforcement

They only exchange the following information:

- Each others state (cut-in or cut-out)
- ACSES remove PTS hold-off request to Cab Signal when required and when cab signal is cut-in. Cab signal enforces PTS if cab signal aspect is restricting.



Review

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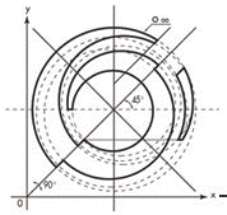
Cab Signal and ACSES interaction

When Cab Signal is cut-in, ACSES will:

- Enforce Civil (track) Speed up to 150 mph
- Display civil speed on the ADU (Lowest of all civil speeds is displayed)
- Remove PTS hold-off request to cab signal when PTS brake curve exceeded.

When Cab Signal is cut-out, ACSES will:

- Enforce Speed up to a maximum of 79 mph
- Display “- -” on the ADU
- Enforce PTS by opening its own Magnet Valve.



ACSES I

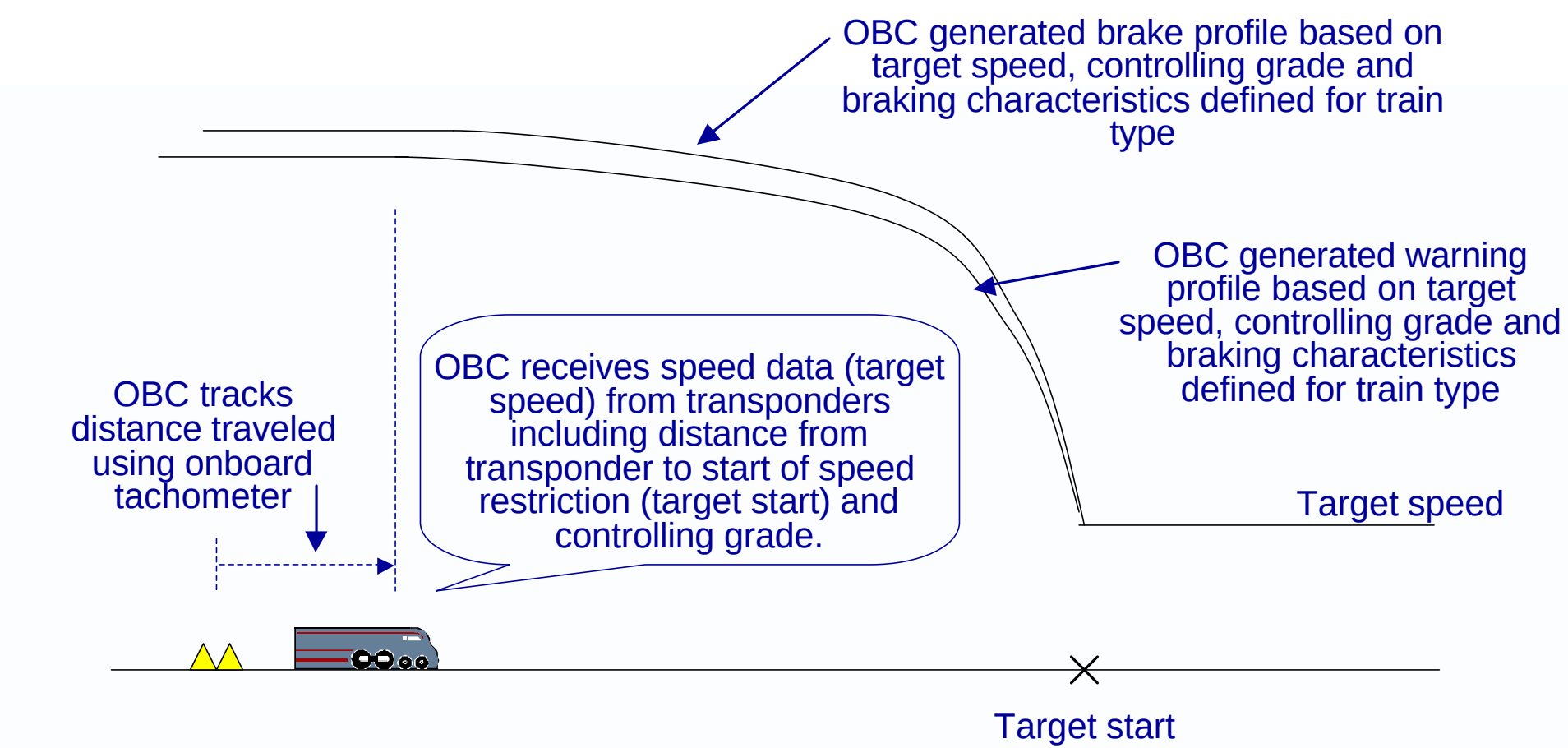
PHASE I Main Functions (In service since December 2000):

- Enforcement of Permanent Civil Speeds including restrictions (PSR) for 5 train types.
- Enforcement of Positive Train Stop (PTS) at Interlockings without radio release.

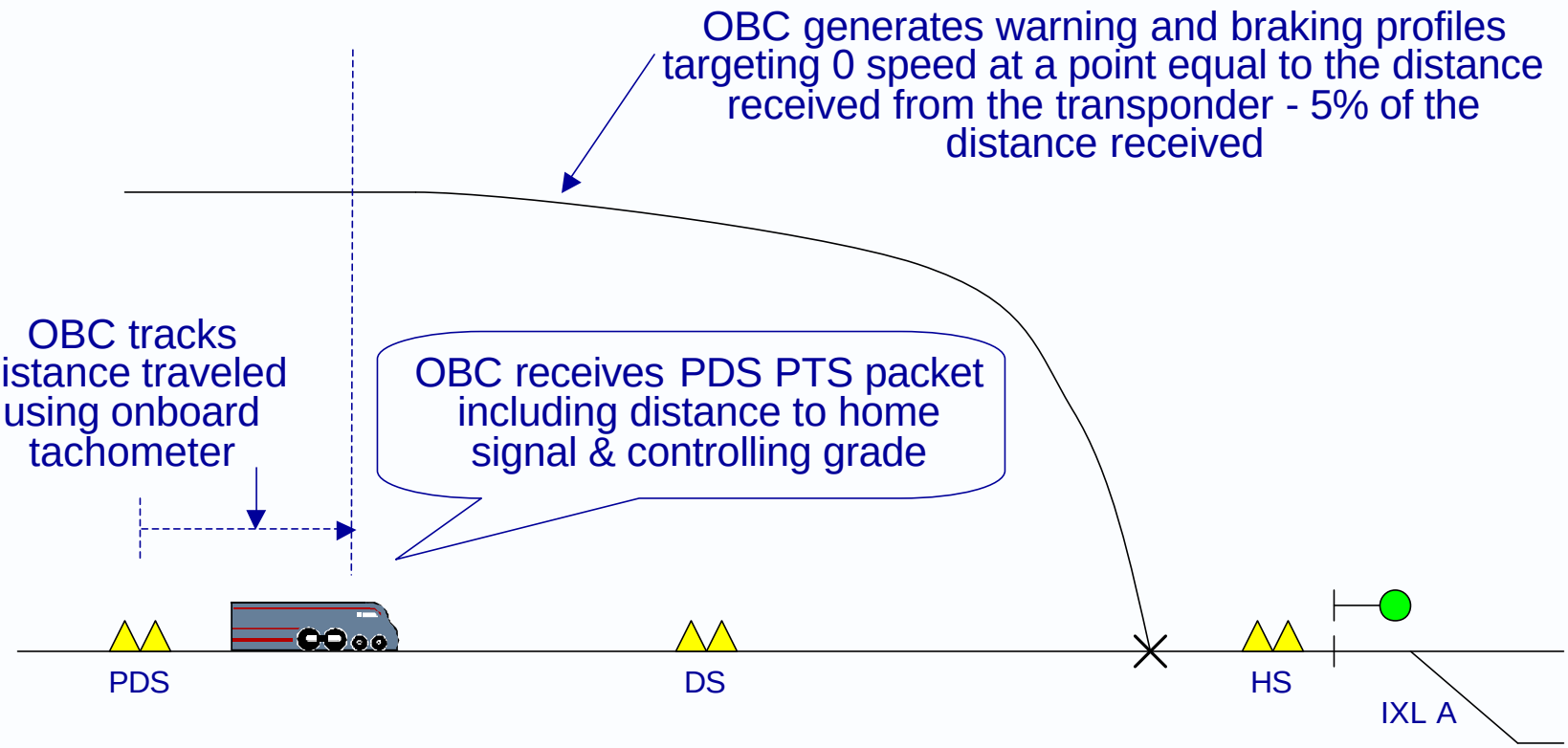
PHASE 2 Main Functions:

- Radio release of the PTS requirement to stop short of the IXL HS (PTSO).

PSR - Basic Operation example

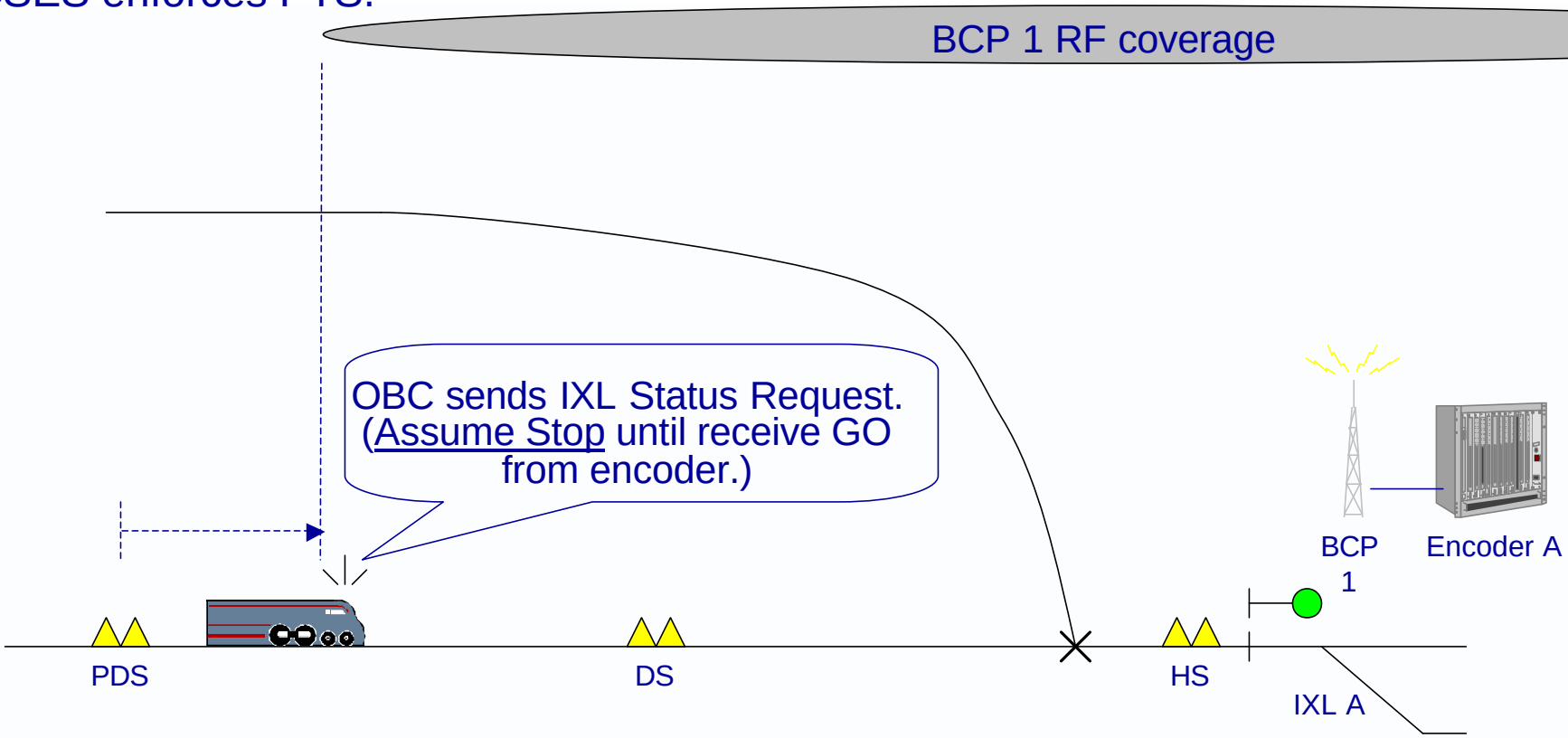


PTS - Basic Operation example

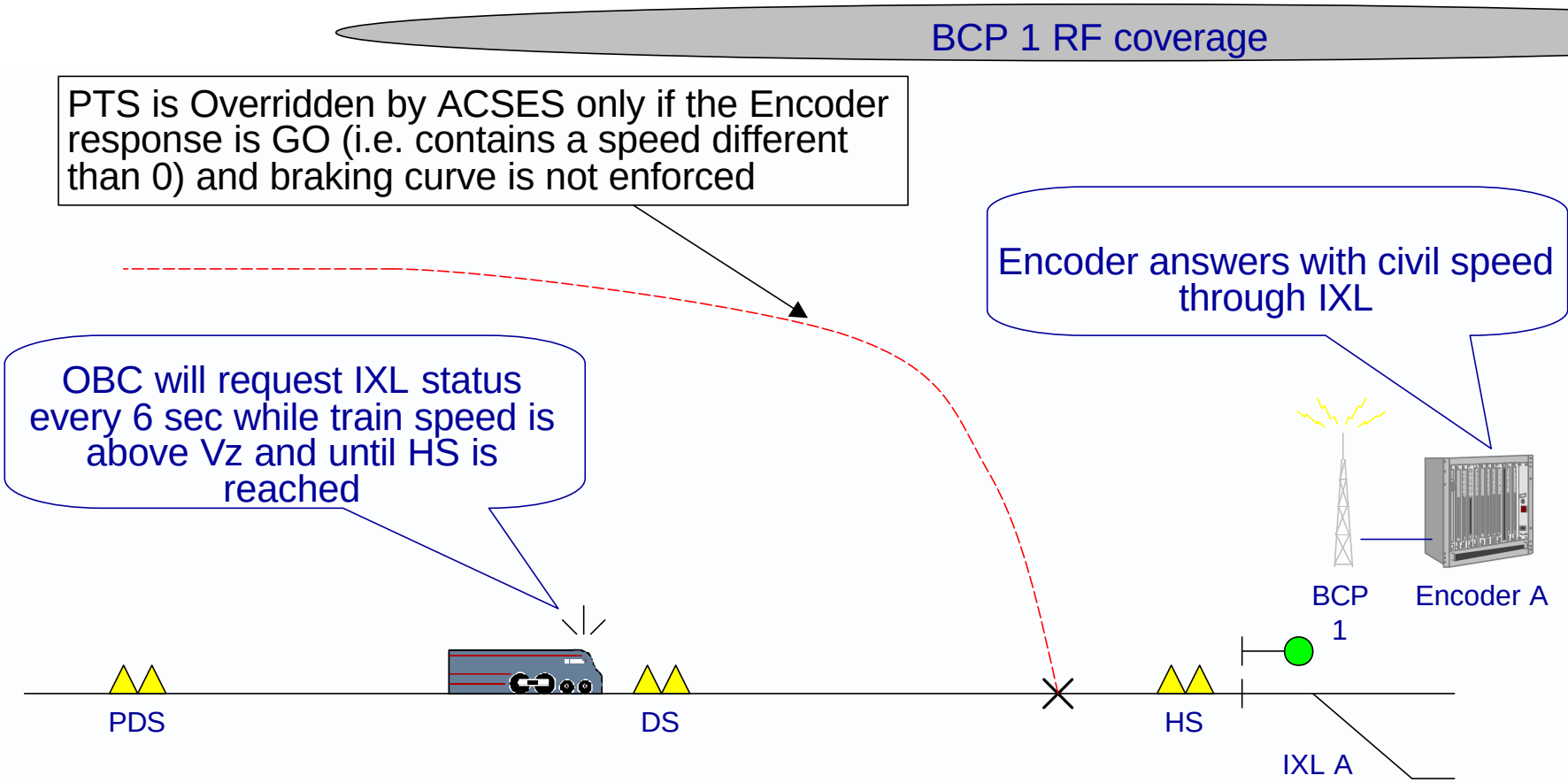


Initial PTSO - Basic Operation example

ACSES PTS operation - If cab signal is more favorable than restricting ACSES request for PTS is automatically over ridden by Cab system. If cab system is cutout ACSES enforces PTS.

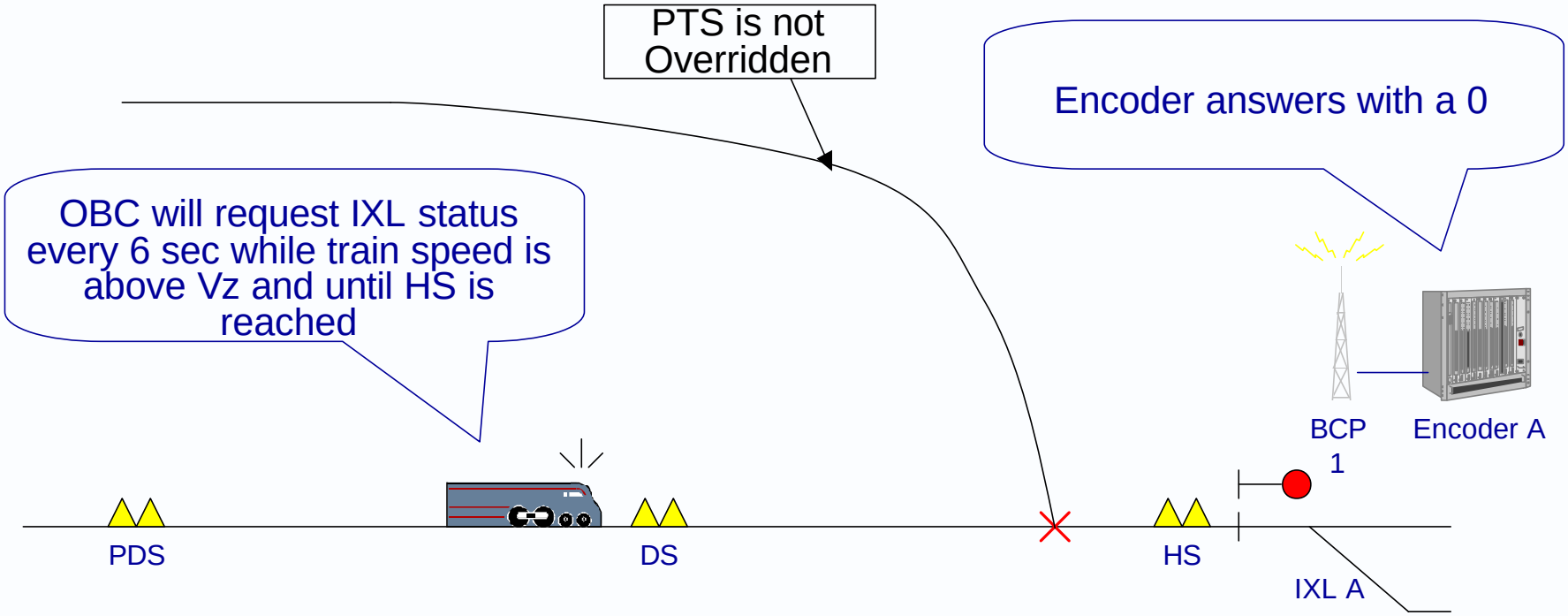


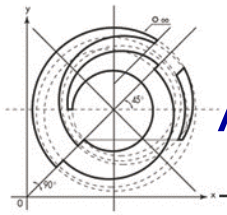
Initial PTSO - Basic Operation example



Initial PTSO - Basic Operation example

BCP 1 RF coverage





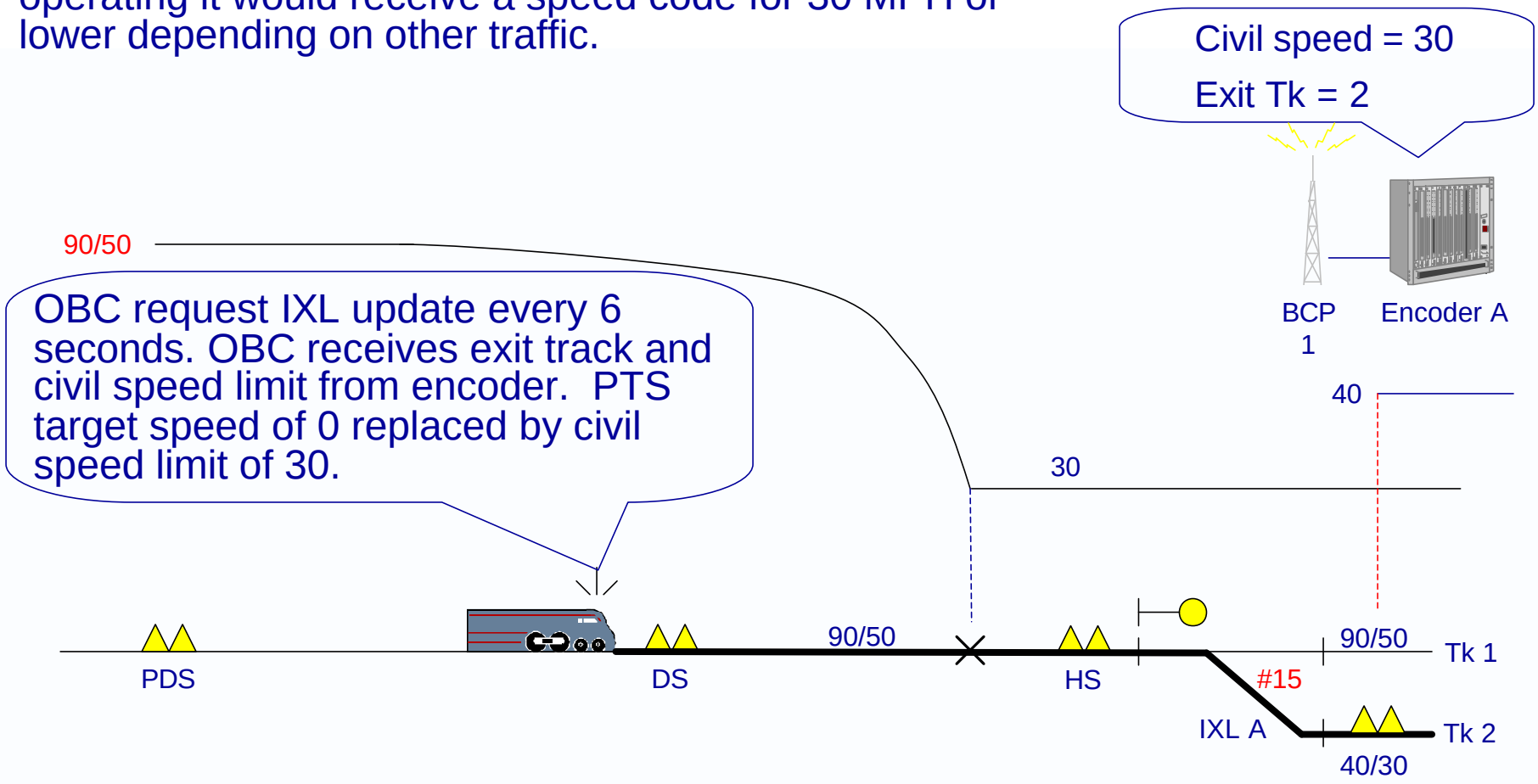
ACSES II

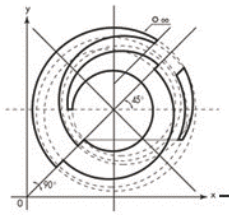
Main Functions:

- Enforce civil speed limit through interlocking
- Load Temporary Speed Restrictions (TSR) data from CETC to train over radio
- Enforce TSR

Full PTSO

Cab signal operates independently of ACSES. If cut in and operating it would receive a speed code for 30 MPH or lower depending on other traffic.





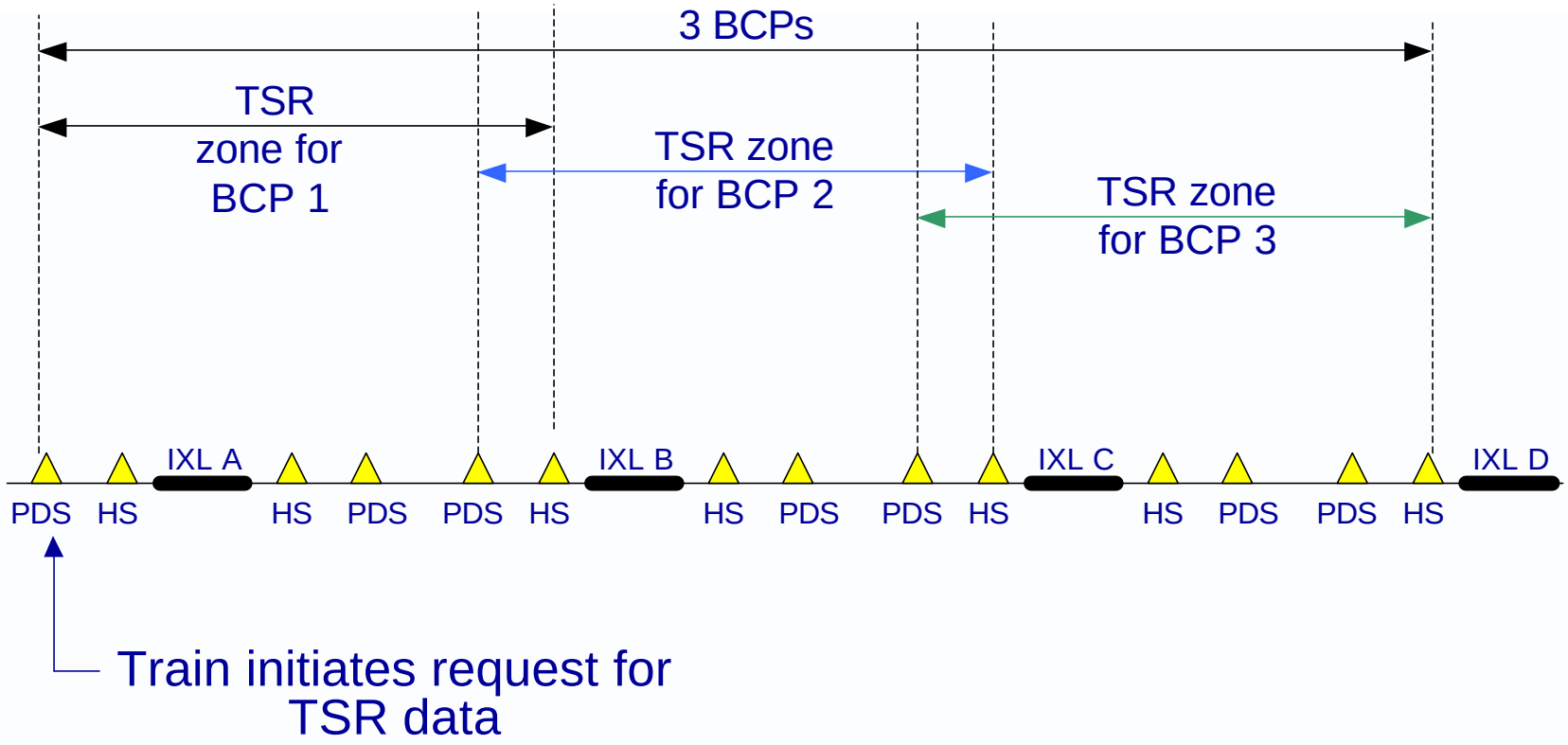
TSR

TSR DATA

- Input from CETC
  - must be verified and approved by supervisor before it is accepted
- Sent to requesting Train
  - speed limit for Passenger/freight
  - start of TSR
  - length of TSR
  - tracks TSR is applied to
- TSR sent to train
  - all tracks in train direction of travel
  - 3 BCP coverage areas

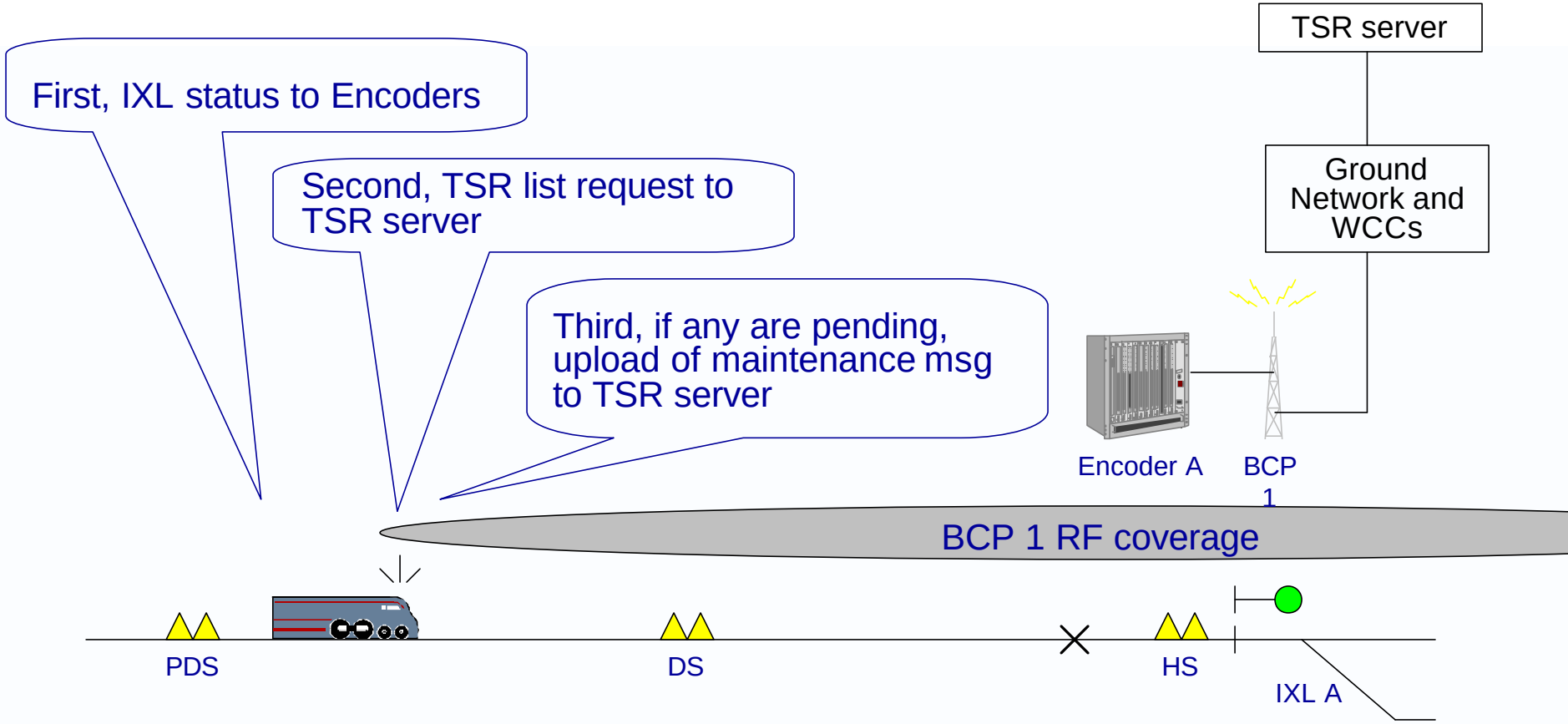
TSR operation

TSR list range of validity (3 BCP)



System Operation

OBC initiate all requests



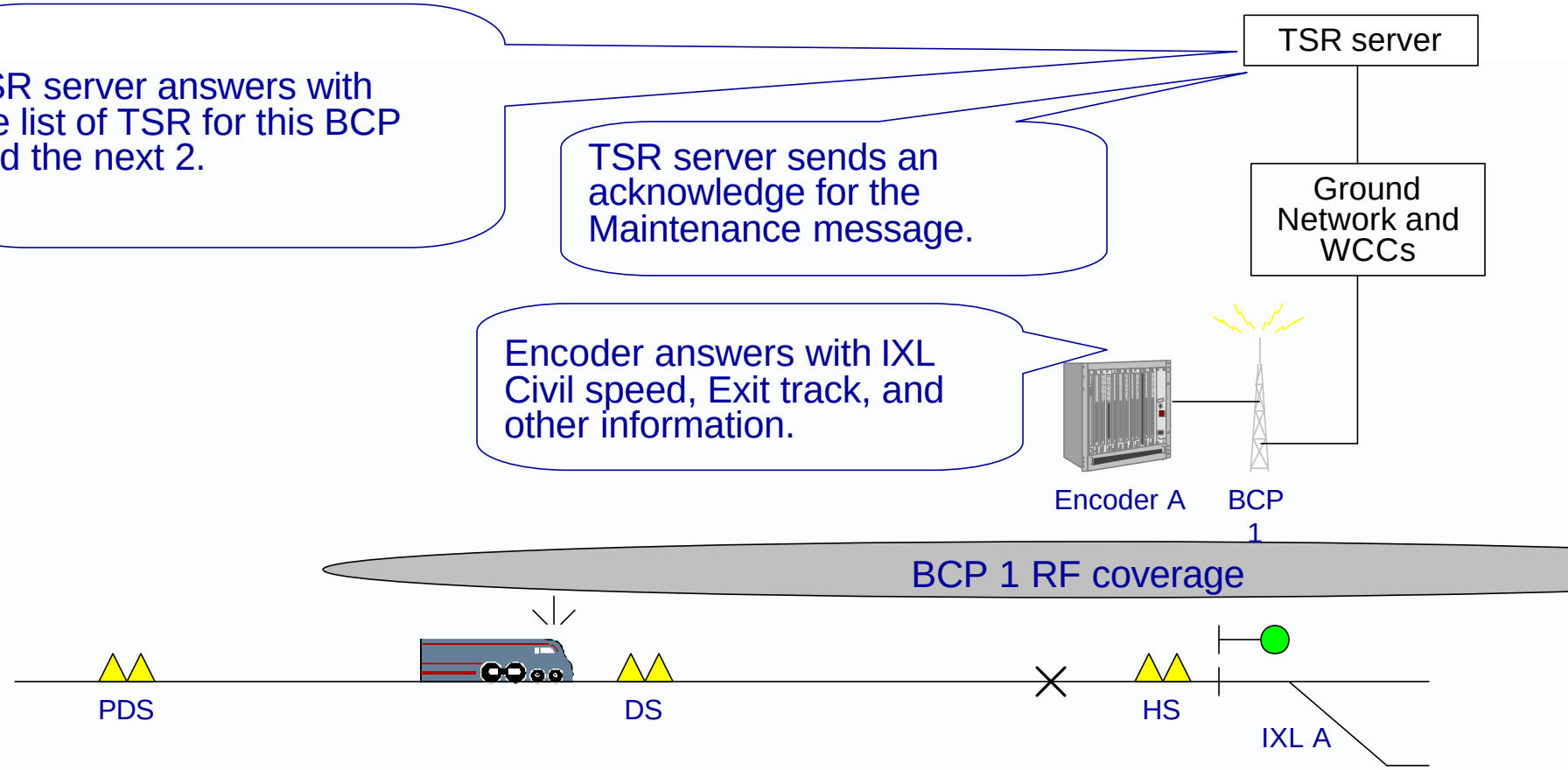
System Operation

OBC receives responses to its requests

TSR server answers with the list of TSR for this BCP and the next 2.

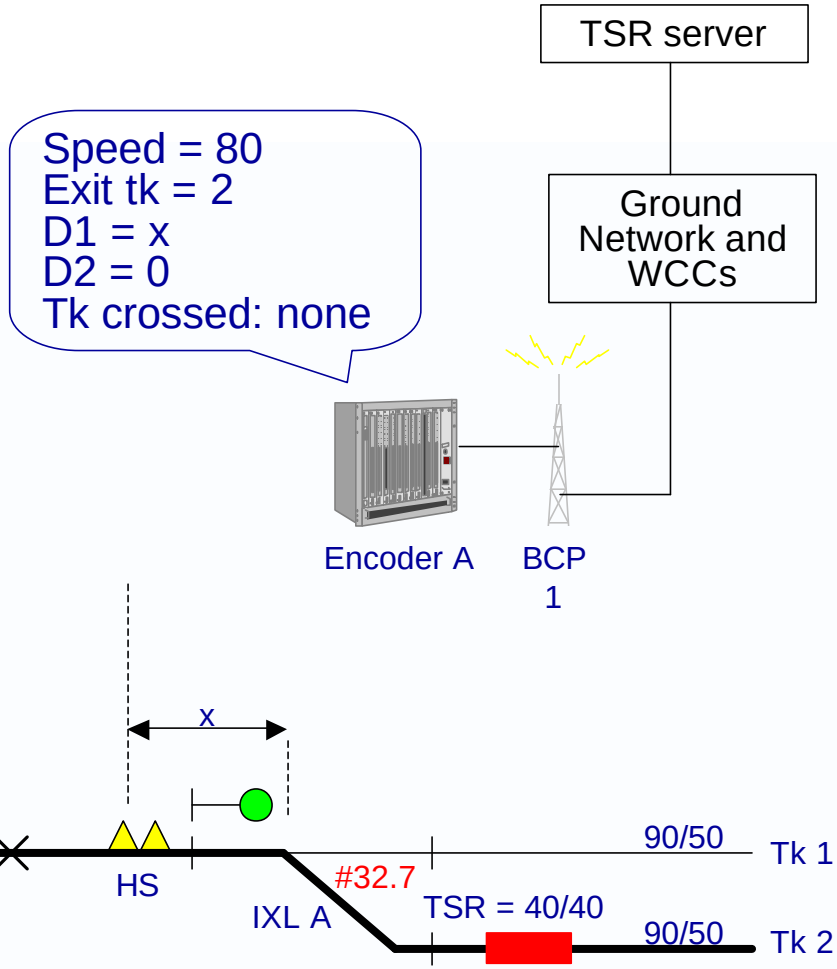
TSR server sends an acknowledge for the Maintenance message.

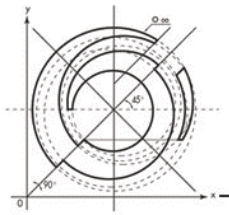
Encoder answers with IXL Civil speed, Exit track, and other information.



ACSES System Operation

- OBC loads the TSR list and identify the TSR on track 2 past IXL A.
- From the encoder response, OBC identifies the exit track and the need to enforce the TSR.
- OBC generates all braking curves
- OBC will enforce lowest of permanent civil speed, radio speed, and TSR.
- OBC continues polling HS every 6s.
- OBC continue requesting TSR list every 60 sec (1 successful upload)
- Cab signal system will independently enforce signal speed limits but can not enforce TSR





ACSES I Phase 1

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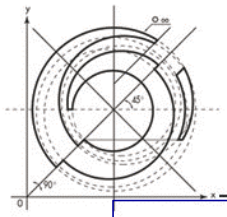
Operational improvements implemented

- train type selection
- speed limit data interpretation for temporary transponders
- requirements for operator acknowledgement
- wheel wear - range, increments and automatic adjustment
- operation if train stops between PDS and DS with PTS pending
- use of installation transponders
- operation in trailing mode
- operation when reversing
- freight warning curve offset from braking curve for PTS



Current ACSES I Phase 1 Activities

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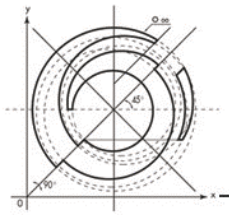
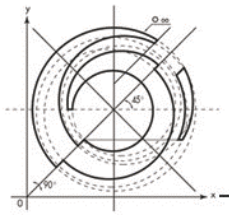
- New Transponder Database
  - current in service database based on 7” under balance
  - new database developed based on 9” under balance
  - database delivered and being installed by Amtrak
- By January - New timetable speeds become effective
  - new database in place, verified and in service
  - New England Division - 154 route miles/327 track miles
  - NYC - Washington - 49 route miles/98 track miles
- Planned additions
  - next year - NYC - Washington - 33 route miles/66 track miles
- Total in service by end of 2003
  - 236 route miles/491 track miles
- Total equipped onboard units = 301to date (total planned = 400)



Current ACSES I Phase 2 Activities

PTSO - Radio release of PTS provided signal is more favorable than stop

- BCPs and encoders currently being installed by Amtrak
- New OBC software being completed by PHW including 3 additional operational improvements
  - operation when a transponder data set is not complete
  - operation when a PTS is pending and train stops in advance of home signal
  - set alarm profile to 3 MPH above speed limit for freight



Current ACSES II Activities

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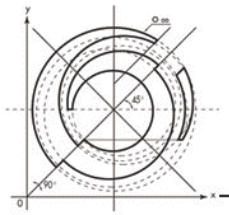
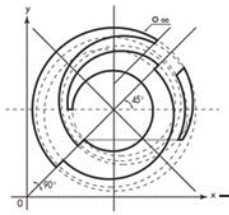
- TSR Server
  - hardware complete
  - software validation test started
- Ground control network
  - hardware complete
  - operational test started
- BCPs & encoders completed as part of ACSES I Phase 2
- OBC software to be completed after completion of field testing for ACSES I Phase 2



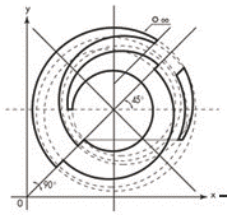
AMTRAK Comments

- System working well
  - proven to be reliable and safe
  - powerful tool
  - engineer's insisting that vehicles be equipped with ACSES
    - especially in curvaceous territory
    - especially with higher speeds allowed by 9" cant deficiency
- Progress being made on freight operation
  - some operational improvements are being investigated
- Temporary Speed Restriction enforcement by installing temporary transponders (only required until ACSES II is in place) has been unsatisfactory from an operations standpoint.



AMTRAK Comments

- ACSES combined with Cab signal provides a
  - system based on proven technology
  - reliable system
  - robust system
  - safe system (including in areas of closely spaced parallel tracks with overbuild)
- When ACSES II is completed it will meet the requirements of a PTC system as established by RSAC / FRA



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